(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
20 January 2005 (20.01.2005)

PCT

(10) International Publication Number
WO 2005/005277 A1

(51) International Patent Classification[7]: B65D 79/00, 17/50

(21) International Application Number: PCT/EP2004/006723

(22) International Filing Date: 22 June 2004 (22.06.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
03254287.0 1 July 2003 (01.07.2003) EP

(71) Applicant *(for AE, AG, AL, AM, AT, AU, AZ, BA, BB, BE, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CY, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, SZ, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW only)*: **CROWN PACKAGING TECHNOLOGY INC** [US/US]; 11535 S.Central Avenue, ALSIP, IL 60803-2599 (US).

(71) Applicant *(for LS only)*: **CROWN PACKAGING UK PLC** [GB/GB]; Downsview Road, Wantage Oxfordshire OX12 9BP (GB).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **CLAYDON, Paul,Charles** [GB/GB]; 35 Elizabeth Drive, Wantage Oxfordshire OX12 9YA (GB).

(74) Agent: **RATLIFF, Ismay,Hilary**; CROWN Packaging UK PLC, Downsview Road, Wantage Oxfordshire OX12 9BP (GB).

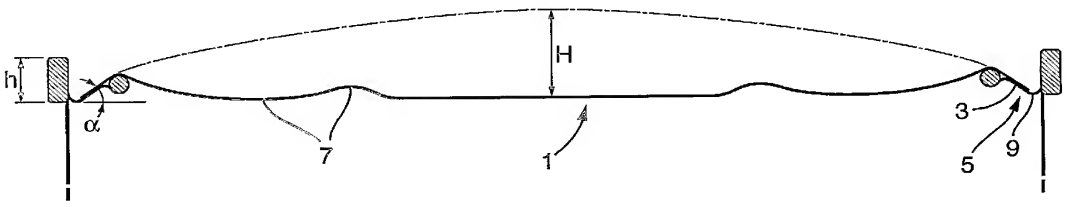
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: CLOSURE



(57) Abstract: A closure for a food can including a foil end panel (1) bonded to an intermediate ring (5) which is fixed to the can body. The foil panel (1) comprises a diaphragm having a centre panel which included at least one concentric bead. The profile of this beaded panel is selected so that its downward position is no greater than the lowest point of the intermediate ring. The provision of the bead(s) reduces pressure differences experienced by the diaphragm, particularly during processing of the can contents, due to the volume increase available from the beads.

WO 2005/005277 A1

CLOSURE

This invention relates to a closure. In particular, it relates to a closure which includes a foil end panel for bonding to a container or, more usually, to an intermediate ring which can then be fixed to a container such as a metal can to close the can.

Such closures are typically intended for closing containers for food and are opened by peeling off the foil panel. The closure, or "peelable end" must be capable of maintaining seal integrity during processing, sterilisation etc. of the food without damage to the foil. However, the closure must also be capable of being readily opened by peeling off the foil panel for access to the food for consumption.

Conventionally, cans closed by peelable ends are processed in overpressure retorts, where in-can pressure generated additional to the vapour pressure of the steam (differential pressure) during the sterilisation process may be balanced by the introduction of air pressure. The use of retorts which do not offer use of overpressure ("non-overpressure retorts"), or higher volume throughput retorts such as hydrostatic and reel and spiral retorts which do not offer the overpressure facility is currently prevented by excessive doming of the foil panel, resulting in damage to the foil, by interference with guide rails.

Foil damage occurs particularly in the centre of the dome by interference with guide rails but may also arise when creasing of the foil from vacuum and pressure results in the development of pin holes and loss of seal integrity. A further problem when non-overpressure

retorts are used is bursting of the seal around the foil panel due to excessive differential pressure.

This invention seeks to overcome these problems which currently prohibit the use of non-overpressure retorts.

According to the present invention, there is provided a closure for fixing to an open end of a container body, the closure comprising a diaphragm bonded to an annular component, the diaphragm having a centre panel which includes at least one concentric bead such that when the closure is fixed to a container and subjected to pressure differentials, the diaphragm is deflectable outwardly to give an increase in container volume, and in which the profile of the diaphragm beaded panel is selected so that its downward form extends at most to the lowest plane of the annular component.

The provision of beads or "corrugations" reduces the pressure difference "seen" by the diaphragm due to the volume increase available from the corrugations.

Preferably, the maximum upward displacement is no greater than the height of a seaming panel of the annular component. This enables the closure to be used where processing using reel and spiral retorts is necessary.

The closure of the invention thus cannot rely on process pressure alone to stretch the foil panel and provide a suitable volume increase for controlling in-can pressure. Instead, the closure of the invention has the stretch introduced into the panel prior to processing, by the provision of the beaded profile. The process pressure differentials therefore simply deflect the beaded profile

into a generally domed shape, thereby providing the required volume increase.

In one embodiment, the diaphragm is bonded to a panel of the annular component, this bonding panel extending radially outwardly and downwardly at an angle of 10° to 20° to the horizontal. By increasing the angle of the bonding panel to a greater angle than the angle subtended by the extremity of the foil panel in its outwardly domed position, the bond only undergoes shear loading which effectively doubles burst pressure performance from that of standard ends which are loaded in peel mode.

Typically, at processing temperatures (e.g. 129°C), the burst pressure of a 73 mm diameter end in peel mode is around 0.3 bar, which increases to approximately 0.6 bar when the angle is increased. Angles of greater than 20°, up to 60° are possible within the scope of the invention so as to provide additional burst pressure performance for domes of greater deflection, but the diaphragm may then become unpeelable unless the panel angle is reduced after processing. Realistically, bonding panel angles of up to 45° give sufficient dome size (i.e. maximum deflection).

Typically, the annular component is a metal ring adapted for seaming to a metal can body. The term "annular" is used herein to include both circular and irregular rings. For example, the annular component may be used with a cuboid container, such as are commonly used for packaging fish. When the closure is used in combination with a cylindrical container, the container

preferably has a side wall height which is less than the diameter of the container.

Since the diaphragm deflects outwardly to control the in-can pressure that can be accommodated by the seal burst pressure resistance, an increase in can volume approximately equal to the thermal expansion of a product in the can and any gases in the headspace is obtained. An aspect ratio for a cylindrical container in which the can height is less than its diameter provides sufficient expansion from the diaphragm for the associated can volume.

According to another aspect of the present invention, there is provided a method of controlling in-can pressure during thermal processing, comprising: bonding a panel to an inclined seal surface of an annular component; stretching the panel; fixing the annular component and panel bonded thereto to a filled can; and processing the contents of the filled and closed can by heating to temperatures of up to 135°C; and providing, at least during the processing step, a generally dome shaped profile to the panel so as to provide an increase in can volume approximately equal to thermal expansion of the contents and gases in any headspace within the can.

Preferably, the method further comprises stretching the panel into a beaded profile which matches the fibre length of the generally domed shaped profile provided during thermal processing.

The inclined seal surface of the annular component may be initially at an angle of from 10° to 60° and the method may further comprise reforming the seal surface to

a shallower angle, or even 0°, after the processing step. In this way, higher angles would be available during processing so that the bond only undergoes shear (not peel) loading and the angle is decreased for end user ease of opening.

A preferred embodiment of the invention will now be described, by way of example only, with reference to the drawings, in which:

Figure 1 is a schematic side view of a foil panel bonded to a metal ring; and

Figure 2 is a schematic side view of the deflected foil panel.

In figure 1, a diaphragm comprising a foil panel 1 is fixed by bonding to an inclined panel 3 of a metal ring 5. Bonding panel 3 has a curled inner edge and is inclined in the example at an angle α (alpha) of 15°.

The profile of the undeflected diaphragm 1 is shown in solid line. This profile extends downwardly from the bonding panel 3 into corrugations 7. The number of corrugations is selected such that no part of the diaphragm extends below the plane of the lowest point of the metal ring (here shown at 9) for ease of handling and without risk of damage during seaming to a can body. The corrugation provide sufficient stretch to accommodate in-can pressure without exceeding maximum burst pressure. Minimal internal pressure is required for the beaded profile to "flip" outwardly to a domed form, this form still being capable of handling without additional risk of damage.

In figure 2, it can be seen that the seal surface is inclined at angle α (alpha) which is greater than the foil tangent angle β (beta). This eliminates the peel component and maximises bond failure pressure.

The highest point of the dome in figure 2 lies below the top of the seaming panel/double seam for use in a reel and spiral cooker. Where standard non-overpressure retorts are used, this is not an issue and the fully deflected profile of the foil panel diaphragm as shown by a dotted line in figure 1 may have a height H which exceeds the seaming panel/double seam height h.

CLAIMS:-

1. A closure for fixing to an open end of a container body,

the closure comprising a diaphragm bonded to an annular component,

the diaphragm having a centre panel which includes at least one concentric bead such that when the closure is fixed to a container and subjected to pressure differentials, the diaphragm is deflectable outwardly to give an increase in container volume,

and in which the profile of the diaphragm beaded panel is selected so that its downward form extends at most to the lowest plane of the annular component.

2. A closure according to claim 1, in which the maximum upward displacement of the diaphragm is no greater than the height of a seaming panel of the annular component.

3. A closure according to claim 1 or claim 2, in which the diaphragm is bonded to a panel of the annular component, and that bonding panel extends in a first direction at an angle of 10° to 20° to the horizontal.

4. A closure according to any one of claims 1 to 3, in which the annular component is a metal ring adapted for seaming to a metal can body.

5. The combination of the closure of claims 1 to 4 and a cylindrical container having a side wall height which is less than the diameter of the container.

6. A method of controlling in-can pressure during thermal processing, comprising:

bonding a panel to an inclined seal surface of an annular component;

stretching the panel;

fixing the annular component and panel bonded thereto to a filled can;

processing the contents of the filled and closed can by heating to temperatures of up to 135°C; and

providing, at least during the processing step, a generally dome shaped profile to the panel so as to provide an increase in can volume approximately equal to thermal expansion of the contents and gases in any headspace within the can.

7. A method according to claim 6, further comprising stretching the panel into a beaded profile which matches the fibre length of the generally domed shaped profile provided during thermal processing.

8. A method according to claim 6 or claim 7, in which the inclined seal surface of the annular component is initially at an angle of from 10° to 60°, and the method further comprises reforming the seal surface to a shallower angle, or 0° after the processing step.

Fig. 1.

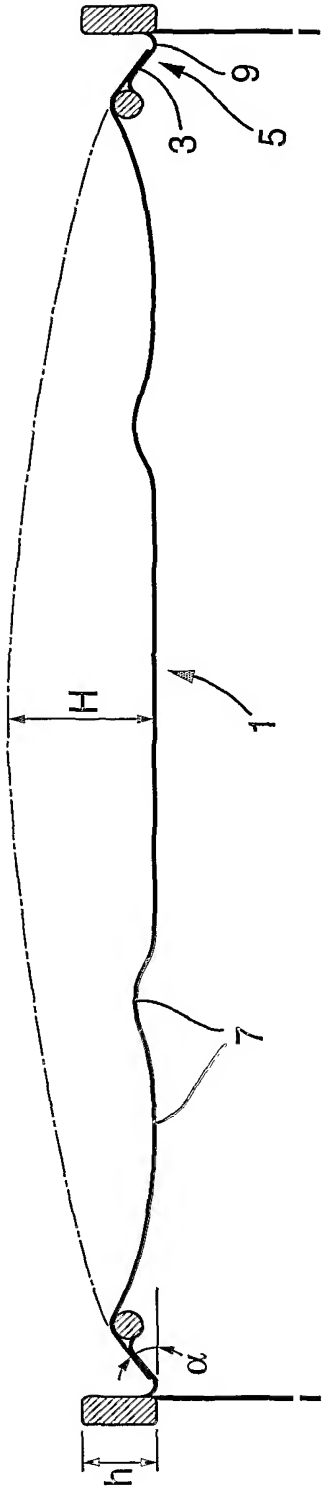
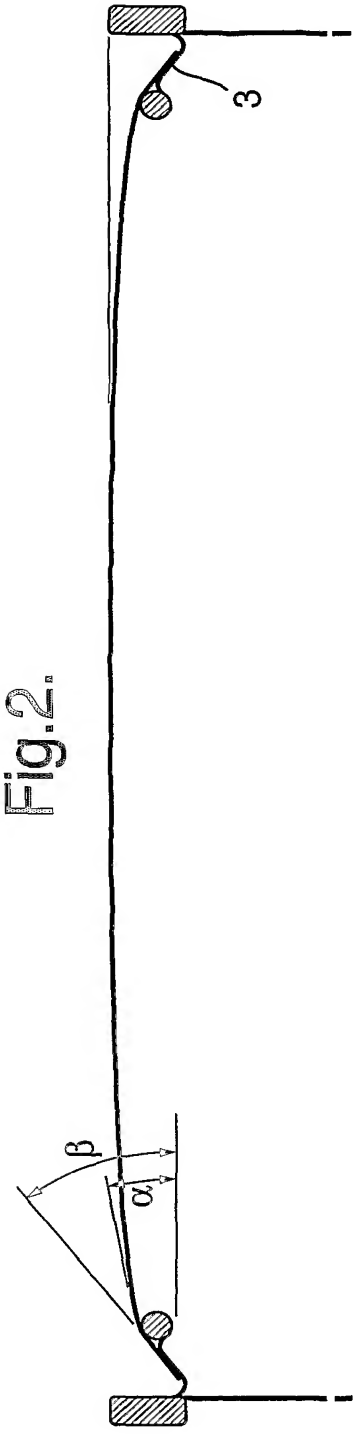


Fig. 2.



INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/006723

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65D79/00 B65D17/50

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 03/006329 A (BALL MELVILLE DOUGLAS ;ALCAN INT LTD (CA); HAMSTRA PETER (CA); MOU) 23 January 2003 (2003-01-23) page 27, line 1 - page 29, line 3; figures 2A,2B,3,4,13	1-8
A	US 3 160 302 A (CHAPLIN GEORGE F) 8 December 1964 (1964-12-08) column 2, line 19 - column 3, line 27; figures 1-4	1-8
A	GB 454 429 A (ROMAN BLACE BUKOLT) 29 September 1936 (1936-09-29) page 1, line 58 - page 2, line 75; figures 1-3	1-8

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 October 2004	15/10/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Lendfers, P

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/006723

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 804 237 A (SLOCUM RAY G ET AL) 8 September 1998 (1998-09-08) column 4, line 12 - column 7, line 4; figures 2B,2C,2D	1-8

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
[redacted]/EP2004/006723

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03006329 A	23-01-2003	US 2002050493 A1	02-05-2002
		US 2003062370 A1	03-04-2003
		WO 03006329 A2	23-01-2003
		CA 2453552 A1	23-01-2003
US 3160302 A	08-12-1964	GB 952665 A	18-03-1964
GB 454429 A	29-09-1936	NONE	
US 5804237 A	08-09-1998	AP 1003 A	17-08-2001
		AU 718405 B2	13-04-2000
		AU 7443796 A	07-05-1997
		BR 9611115 A	13-07-1999
		CA 2234696 A1	24-04-1997
		CN 1203558 A ,B	30-12-1998
		DE 69629397 D1	11-09-2003
		DE 69629397 T2	01-07-2004
		EA 194 B1	24-12-1998
		EP 1369355 A1	10-12-2003
		EP 0906222 A1	07-04-1999
		ES 2205062 T3	01-05-2004
		HK 1016138 A1	02-08-2002
		JP 2001518039 T	09-10-2001
		PL 326168 A1	31-08-1998
		PT 906222 T	31-12-2003
		RO 117250 B	28-12-2001
		TR 9800681 T2	22-10-2001
		WO 9714614 A1	24-04-1997